Winter 2016

vector

SCALING THE DIVIDE

Exploring the connections between engineering and policy

The University of Texas at Austin
Cockrell School of Engineering

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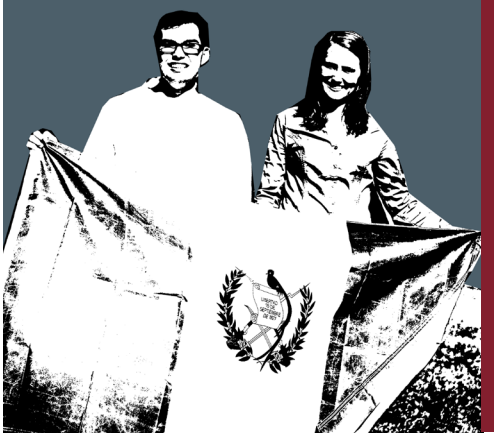


layout by
Rachel Scott

cover photo by
Emily Crowell-Stevens

Letter from the Editors

In the midst of a new American government, burgeoning campus construction developments, and growing community outreach initiatives at home and abroad, the world for all Americans and UT Austin students is changing rapidly -- through a unique marriage of policy and innovation.

This combination of policy and innovation permeates many aspects of engineers' lives on campus and beyond. Vector Magazine, in its first issue of the year featuring the writing, photography, and design work of our new staff, will explore the links between engineering and policy through articles on the Fundamentals of Engineering Exam, new construction developments on campus such as the Speedway Project and the EERC as well as National Science Foundation research funding and engineering outreach in the Austin area and abroad.

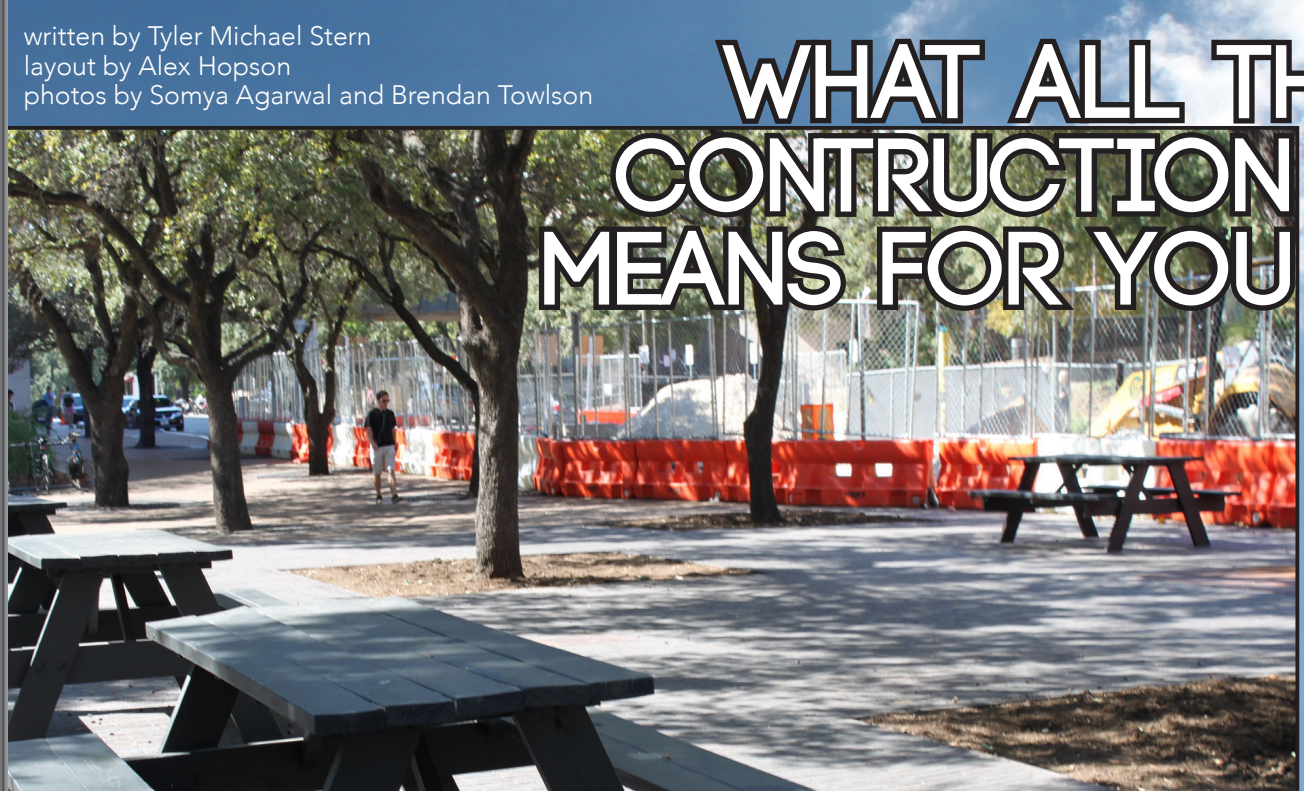
The Lady of Justice, portrayed in contemporary engineer style on the front cover of this magazine by our model, Ross Miglin, serves as a timeless reminder that policy and engineering are inseparable and must be kept in balance without bias; for if we have full knowledge of our impact on society and policy, what we start here will truly change the world.

Best,
Rachel Scott & Emily Crowell-Stevens

SPEEDWAY, SLOW DOWN!

written by Tyler Michael Stern
layout by Alex Hopson
photos by Somya Agarwal and Brendan Towlson

WHAT ALL THIS CONTRUCTION MEANS FOR YOU



UNDER CONSTRUCTION

The Speedway Mall Renovation is 1 of 8 major renovations recommended in UT Austin's 2012 Campus Master Plan.

When finished, the Speedway Mall will be a 36-foot wide pedestrian friendly space. The space is about 12 acres, extending a half mile between Dean Keeton and the Blanton Museum of Art.

The next phase of this project involves an update of the East Mall area.

This project has been in the works since the year 1999.

There will be four locations for food trucks: two at 21st and Speedway and two at 24th and Speedway.

The Landscape Architect for the Speedway Mall project is Peter Walker and Partners, from Berkeley, California.

The new Speedway Mall is eco-friendly: the area of paved space is set to decrease 20% as a result of this project, and over 100 new trees will be planted, almost doubling the number of trees in the 12-acre space.

Engineering & Energy Policy

providing power to the lonestar state

written by crystal huang
layout by vinay soni
photos by leslie zhang

Texas is synonymous with energy. The Lone Star State isn't only a producer of oil and gas, it's also a top ten state for potential wind and solar energy. Due to Texas's influential position, energy policy decisions made in Texas should be based on sound technical expertise. Engineers can choose to follow the current energy policy, or choose to shape it, in either a technical or nontechnical way.

For the most part, engineers do not directly shape energy policy. Instead, "engineers are constantly working to make all energy sources more inexpensive," said David Spence, professor of law, politics & regulation. "This constant competition drives prices down. Policy is an overlay on top of that. Engineers need to understand regulations to do their jobs."

But Fred Beach, Assistant Director at the Energy Institute, would like to change engineers' role in policy. Beach teaches the tech elective "Energy, Technology and Policy" within the Cockrell School of Engineering. "I want my students to take away a high level understanding of the energy economy and the impact it has on the way we live and our environment," Beach said.

As a result, Beach believes engineers can be more involved in decision making processes. "Currently, important decisions are made by lawyers and politicians, [who then] come to engineers at the very end," said Beach.

For instance, instead of lawyers and politicians requesting engineers to design a corn ethanol plant they have already decided on, they should ask engineers what the best alternative is to gasoline."[During the brainstorming phase is] where engineers can get involved from an efficiency perspective and from an energy balance perspective," Beach said.

Moreover, engineers have the flexibility to delve into less technical roles that are closer to policy than engineering. Aanandh Chandrasekar, chemical engineering junior, has done just that.

As a freshman, Chandrasekar found a research position in the Lyndon Baines Johnson School of Public Affairs, studying the spread of renewable technology with Varun Rai, associate professor of public affairs. Rai has a background in engineering, having earned his undergraduate degree at Indian Institute of Technology Kharagpur. "Then he came [to the US] and did a complete switch to the social sciences," said Chandrasekar. "He has a very interesting perspective and his research is very vigorous."

This year, Chandrasekar is working with Austin Technology Incubator, which provides funding and support to startups in Austin. "I get to talk to all sorts of stakeholders, such as the Austin Chamber of Commerce and [solar panel company] Sunpower," said Chandrasekar. Working at Austin Technology Incubator has let Chandrasekar see and affect the bigger picture, from venture capital investment to macroeconomic trends. Ultimately, Chandrasekar's work will help the City of Austin make better energy policy decisions.

Energy policy is an important topic engineers can be more involved in, especially for engineering students at UT Austin. "If Texas is the energy state, UT Austin is the energy university," said Beach. UT Austin graduates will go on to affect energy policy in Texas and beyond.

MO' MONEY Solving MO' PROBLEMS

Groundbreaking research done through NSF on the Forty Acres

written by Haris Rafiq
layout by Arqa Mast
photo by Parisa Maesumi

What allows science to progress? Well, most would be quick to answer with research... and that's true! But there's a nuance to academic research that is often overlooked, and that nuance is funding. In order to build and operate technical equipment, pay full-time researchers, and subsidize the acquisition of specialized materials, a research team needs money!

One of research's greatest friends in America is the National Science Foundation (NSF); for the fiscal year of 2016, Congress appropriated $7 billion towards the NSF. In order to utilize these funds, research teams send proposals to the NSF, which then authorizes grants. Obviously, the government strongly influences research projects through its funding system.

Recently, a research team on our very own 40 Acres secured a grant -- through the aid of federal dollars, scientists at UT Austin are attempting to push the boundaries of science.

Andrea Alù, electrical and computer engineering associate professor and Wireless Networking and Communications Group affiliate, is embarking on an exciting four-year journey to discover new ways to propagate light and sound waves. As part of the National Science Foundation's multi-campus Emerging Frontiers in Research and Innovation Program, Alù's team has been awarded a $2 million grant to conduct groundbreaking research and development. Research so groundbreaking, in fact, that Dr. Alù plans to find ways to "control light with sound, or sound with light." Essentially, UT Austin's NewLAW team aims to "reduce interference during the propagation of waves using innovative techniques and equipment." It's a complicated concept to understand, but it's definitely easy to grasp exactly why the NSF is enthusiastic about supporting such monumental research.

> "...gateway for research and innovation."
> - Dr. Andrea Alù

When asked to weigh in on the importance of the NSF and its granting process, Dr. Alù enthusiastically supported it as a "gateway for research and innovation". The NSF doles out funds for the completion of important research; as a government agency dedicated to ensuring that scientific progress is made, the NSF opens up opportunities for scores of research teams across the nation annually.

On the flipside, chemical engineering professor Gary Rochelle explained how he received funding without help from the NSF. "I submitted a proposal for funding 35 years ago to the NSF and was rejected," said Rochelle. Rochelle is conducting research with a focus on carbon dioxide capture and and the energy involved in this process. Rochelle's research proposal was subsequently rejected by the NSF for "being too mission-based", and he instead receives funding for his research from "ten different industrial companies."

Regardless of the source of funding, when it comes to research, money is a big deal. Every research team has its own niche in the science community and a corresponding route to obtaining results -- receiving funds isn't an easy process, and this process isn't a fun one, yet the advancement of science with NewLAW or the environmental benefits of carbon dioxide capturing both demonstrate that this process is an important one!

pictured: Dr. Andrea Alù

Whenever I get an email from a student who includes their UT EID, I think to myself, "This kid's going somewhere.

Just like you, advisors can feel overwhelmed during mid-terms and finals, especially when we see a room full of students on deadline days. Which means, if you want to be your advisor's favorite student, don't wait until the day of a deadline to try and drop a class or take care of any other time sensitive business.

Advisors don't just ask you to follow-up with them as a way to end your appointment. We really do like it when our students touch base with us and let us know if they still need assistance. We also really love to hear from our students when things are going well, so don't be a stranger!

Confessions from the Advising Office

I wish students would put their cell phones away and stop texting. I'm pretty sure you made the appointment with me, not the other way around :)

layout by Rachel Scott

I know we all get overwhelmed by email, but it drives me crazy when a student says "I didn't get that email" and I can see electronically that they simply never opened it! Come on, don't blame the system when you don't open your mail- take responsibility, email is the official form of communication at UT!

I wish students would not worry as much as about their GPA and focus on really learning the things they are interested in.

What I want students to know is that YOU CAN DO IT! Just hang in there, but you BELONG in the Cockrell School. Just hang in there!

yes!

Engineers pursuing government through the Archer Fellowship

It's often said that engineers are known for their problem solving abilities. That's why some people tell employers about how great of a problem solver they are, whether it's true or not. However, as those problems get bigger and more difficult to solve, it may be beneficial to step out of that engineering mindset. Several UT Austin engineers have been exploring those outside perspectives and gaining professional experience through the Archer Fellowship Program.

The Archer Fellowship Program enables motivated students from any school in the UT system to spend a semester interning and taking classes in Washington D.C. While it is true that the program consists of many liberal arts majors, engineers have found applied, been accepted, and interned in places like the White House or Department of Energy. Christine Anderson, recruitment and admissions coordinator for the Archer Center in D.C., expressed that engineers aren't just encouraged to apply because solving complex problems is almost always an interdisciplinary endeavor.

Christine stated that when it comes to the great policy challenges we face, she wants engineers involved in finding solutions. "While we definitely need those students whose background is in government or liberal arts, better policy will happen when we have other experts at the table as well. We want to educate the next generation of engineering leaders on the role and importance of policy to their profession so that they can make a difference and have a voice in engineering policy," Christine said.

It's not unfair to ask, "why should engineers even care about government?" I posed that exact question to Ed Dorn, a former Assistant Secretary of Defense and the Dean of the LBJ School of Public Affairs for 7 years. "Government makes a lot of decisions that affect engineering standards, and what kind of things are going to get built, [for example] whether the government is going to spend more money on highways, on

rail, or on air transport," said Dr. Dorn. "It's going to make a lot of difference whether an aerospace engineer gets paid a lot of money, or a civil engineer gets paid a lot of money." Knowledge of how the government works helps you understand the bigger picture; seeing how the project you're working on fits into the larger goals of the company is very important to potential employers.

There's nowhere better for a UT engineer to learn more about government than in the nation's capitol. That's where the Archer Fellowship comes into play.

One the perks of being an Archer Fellow is that the Archer Center advisors help participants along every step of internship applications. "They also help you find internships that have meaningful work," said Gregory Ross, a chemical engineering junior who's interning through Archer for the Spring of 2017. By the time a fellow is ready to apply for those D.C. internships, their resume and professional correspondences will be revised to near perfection.

The Archer Fellowship is also a source of unparalleled professional development. You'll work in a fast paced city, with the nation's finest young minds (and a few old ones). Zeyi Lin is a computer engineering senior who interned at the White House Office of Science and Technology Policy during his semester as an Archer Fellow, and the experience helped him grow in subtle ways that can't necessarily be stated on a resume.

"I thought that a lot of my coursework in ECE helped guide my understanding of the technology issues in general, but I grew significantly on the job itself," said Lin. "I am incredibly appreciative of the mentors who helped me develop professionally while I was there". Because Archer Fellows intern full-time for a whole semester, they get more experience as valued employees than with the typical summer internship.

"We want to educate the next generation of engineering leaders on the role and importance of policy to their profession"

- Christine Anderson
Archer Center, D.C.

Gregory Ross,
Archer Fellow for Spring 2017

Working full time in the epicenter of U.S. policy making doesn't mean there's no fun to be had off the clock. Archer Fellows live together in luxury apartments right next to Union Station, and the D.C. Metro is much easier to navigate than it's New York cousin. The nation's capitol is also home to some of the most famous monuments in America. It's amazing to walk the National Mall and see memorials like the Washington Monument and the Vietnam Veterans War Memorial Wall. The National Mall is also home to the world renowned Smithsonian museums, which are free to the public.

The application to the Archer Fellowship Program opens on November 2nd and closes February 15. If you have any questions, swing by FAC 338 for more information.

written by Jonathan Markel

layout by Zelenny Lozano

photo by Allie Runas

WHERE HAVE ARCHER FELLOWS INTERNED IN THE PAST?

POLITICS

Amnesty International
Democratic National Committee
Department of Justice
Department of State
Embassies of Various Countries
Office of the Executive
United Nations
U.S. House of Representatives
U.S. Senate
The White House

SCIENCE

American Association for the Advancement of Science
Defense Advanced Research Projects Agency
Environmental Protection Agency
Food and Drug Administration

MEDIA

ABC News
CNN
Meet the Press
National Public Radio

BUILDING A NEW CHAPTER FOR UT ENGINEERS

ENGINEERING INNOVATION:

Walking down Speedway, a tall, partially-assembled edifice has become a familiar sight for engineering students. Students walk or run on their way to class, many instinctively looking up at it while they pass. Construction workers mill around the building on all sides, each day bringing it closer and closer to its final product. The Engineering Education and Research Center may have only broken ground in 2015, but it has been a work in progress for much longer.

"The plan and concept to develop an interdisciplinary space have already been on the books since the 2000's," said John Ekerdt, chemical engineering professor and associate dean of research. "Looking at on-campus facilities, there was a need to replace ENS [Engineering-Science Building] and that was where we decided the EERC would be."

The ENS was the home of electrical and computer engineering, the largest engineering major on campus. Unfortunately, the building was outdated and lacked many of the common features seen in newer buildings around campus. In short, it was not a place that encouraged socialization and innovation in engineering students. The EERC hopes to remediate this.

Walter Oji, electrical and computer engineering senior, said, "Having the EERC will enable EE students to collaborate in a way that simply has not been possible for the past few years."

Collaboration is one of the key goals of the EERC. From the tenth floor of Ernest Cockrell Jr. Hall, where John Ekerdt's office is located, one can watch the glass panes being added to the sides.

"We wanted the EERC to be an opportunity for collaboration," said Ekerdt. "The glass, open layout, and overall design will be able to facilitate innovation that we cannot even imagine yet."

While the South Tower will be the new home for the Department of Electrical and Computer Engineering, the North Tower will be for multidisciplinary research. Another key component of the design will be the open atrium that links the two towers, which is also symbolic of the building's interdisciplinary focus.

"With its atrium and labs in dialogue, students will be able to collaborate in new and exciting ways," said Katie Mark, architecture and architectural engineering senior. "The building's layout will further facilitate interdisciplinary interactions and fit into the fabric of campus much better than its predecessor."

One phrase that has been mentioned often by Ekerdt and others involved in the EERC design process has been "random collisions." The glass-centric design is also meant to allow students to see what their peers are doing in the labs and rooms lining the atrium. It is not just supposed to be a space where students can study and socialize, as that can be done anywhere else on campus. Instead, the EERC will be where students can actualize their ideas and work with others from across majors.

Oji said, "We will be able to push the boundaries of what we are capable of [and] create a deeper sense of community and connectivity."

The atrium will also provide a place conducive for networking. According to Oji, the open space is ideal for corporate partners to interact with students for info sessions and recruiting opportunities. "Increasing casual contacts between students and company representatives is the first step to helping EE students figure out what they want to pursue in the Electrical and Computer Engineering field," said Oji.

In addition to the atrium, there will also be interdisciplinary teaching laboratories, a study loft area, and an innovation center. Ekerdt said, "Floors zero, one, and two are really designed to be a common space for students. It's student-centered, a student space to facilitate learning and collaboration across groups." Several student organizations, as well as Engineering Student Services, will have new homes in the EERC.

All of this is to draw students in and be a place where students naturally want to gather, especially EE students who have not had a central hub for a few years. Oji hopes that it'll be "a place where you'd be as likely to happen upon an upperclassmen with experience that would help you to be even more successful. Or

stumble upon an underclassmen who is [in] need of guidance."

Looking at the campus from the tenth floor, one can see the variety of buildings that house various departments and majors. There's the older style of the "six pack" and Tower, as well as the newer style of Gates Dell Complex and Biomedical Engineering Building. Soon, the EERC will be another distinctive

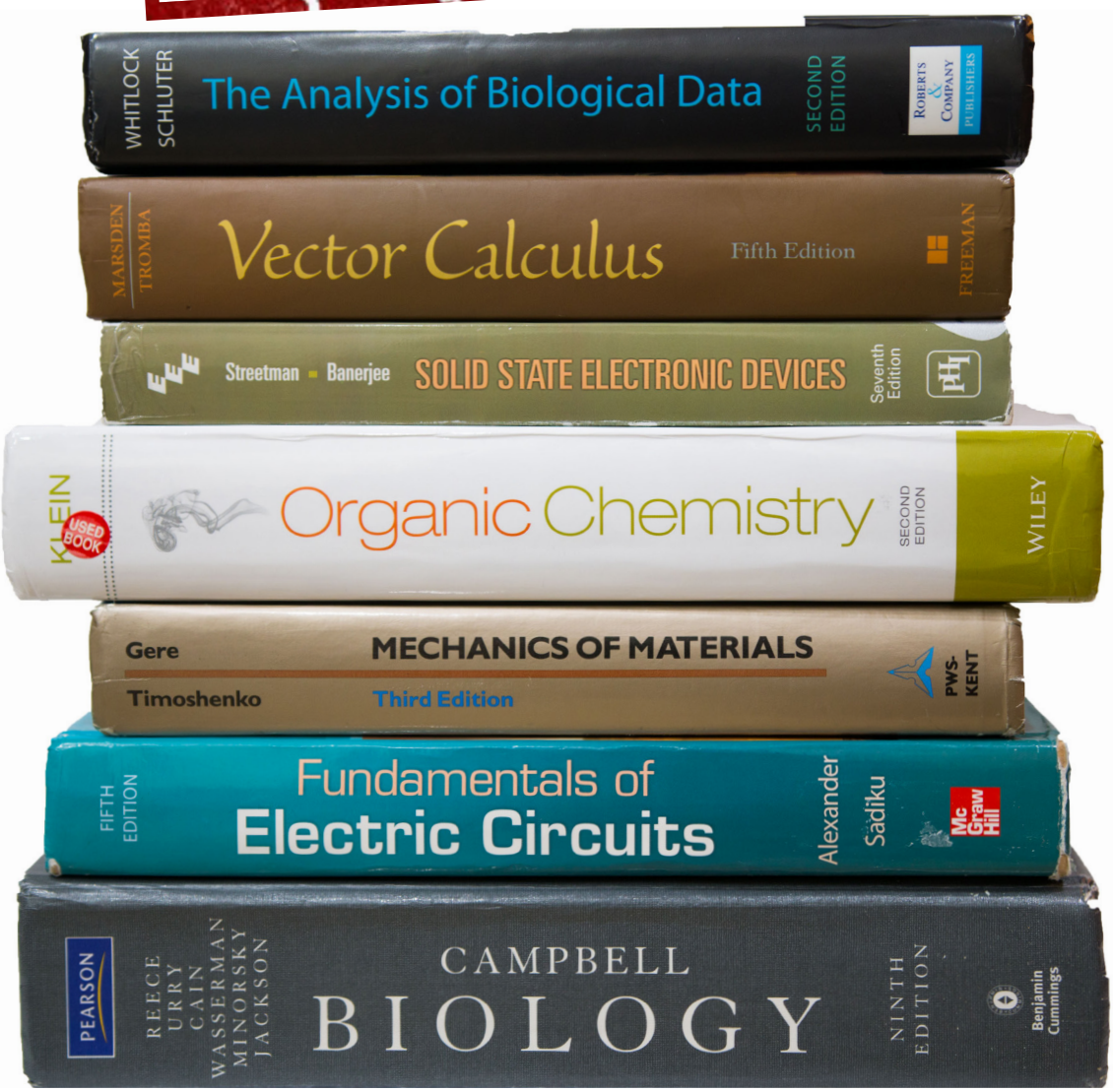
> WE WANTED THE EERC TO BE AN OPPORTUNITY FOR COLLABORATION . . . ABLE TO FACILITATE INNOVATION THAT WE CANNOT EVEN IMAGINE YET

landmark to add to the map. Oji believes that the EERC will be a "symbol of hope and success for the EE department." And for those who have been involved in the design since the beginning, walking into the atrium when doors open will be a much awaited moment.

"This has been an exciting opportunity to create for students, faculty, and staff," said Ekerdt. "It's been transformative to be a part of making all of this a reality. Ultimately, we want this to a place where students will be proud to be a Cockrell engineering student and inspired to learn."

written by ana chan
layout by vinay soni
photos by brendan towlson

CONQUERING THE FE EXAM



[It's] an important step towards becoming a professional engineer.

written by Tyler Michael Stern
layout by Emily Hood
photo by Parisa Maesumi

At approximately 3:15pm on March 18, 1937, the London School, in New London, Texas, exploded. The walls of the building swelled and burst; the roof was launched skyward. A two-ton brick of concrete soared through the air and crash landed on a 1936 Chevy. The vehicle was parked two miles away.

Nearly 300 people were killed, and almost all of them were elementary school students and teachers. The New London School Explosion was the third deadliest disaster to ever occur in the state of Texas. Engineering errors led to a buildup of natural gas in the crawlspace beneath the school, which was set off by sparks from an electric sander. Clearly, engineering mistakes can have some serious consequences.

It was under these circumstances that the Texas Board of Professional Engineers (TBPE) was formed by the Texas State Legislature. The TBPE is the regulatory body in charge of administering the Fundamentals of Engineering (FE) exam and the Professional Engineer (PE) License. The TBPE is in charge of ensuring that all engineers who choose to work in service of the general public are prepared to do their job well. The board accomplishes this by awarding the certification of Professional Engineer to those who are deserving.

A Professional Engineering license is a certification which signifies mastery of many core engineering skills. This license is required for submitting design documents or drawings to ny public authority. A PE license is required for many positions in government engineering work, consulting, design, and many other engineering subfields.

The first step to becoming a professional engineer is to get a degree from an accredited program. After graduating (or as early as two semesters before graduation), anyone who wants to earn a PE license should take the FE exam.

The FE exam is a written test, administered on a computer in a testing center. There are several testing centers in Texas which administer the FE exam, including two in Austin. It costs $225 to take the exam and the exam can be taken any number of times. The exam takes about 6 hours, including a 25 minute break and an 8 minute tutorial on how to use the testing system. There are 110 questions.

There are seven different discipline specific exams available, in the fields of chemical, mechanical, civil, environmental, electrical and computer, and industry and systems engineering, as well as an "other disciplines" exam. Any of the seven is an excellent first step toward becoming a professional engineer.

The next step for many future PE certified engineers is to become an Engineer in Training (EIT). EIT certification denotes that a person has taken and passed the FE exam and demonstrates intent to take the PE exam in the future. This classification is considered desirable by many employers, and is a great way to stay on track to attaining PE status. One of the best parts of becoming an Engineer in Training is that it is very easy to accomplish. All that is required is $15 and an online application.

To obtain a Professional Engineering license, it's first necessary to take care of the "3 E's:" Education, Experience, and Exams. PE licensure requires a degree, typically in engineering, taking the FE and PE exams, and a set number of years of experience working as an engineer. For anyone with an engineering degree from UT Austin (where all of the programs are ABET certified), PE licensure requires 4 years of experience in the workforce. However, 2016 is the first year in which Engineers in Training can apply to take the PE exam without having fully completed their experience in the workforce. After applying to take the exam and being approved, the PE exam can be taken three times.

The FE exam is an important step toward becoming a professional engineer. It's not for everyone, but there are certainly benefits for most budding engineers.

The Engineer-Politician

Do they exist, and what can they bring to the table for the future of our country?

written by Sarika Sabnis / layout by Jared Cormier / photos by Allie Runas

The image of the politician today often stirs up images of lawyers, businessmen, economists, and even doctors. From Franklin Delano Roosevelt to George W. Bush to Barack Obama to Rand Paul, the professions of most of these politicians prior to their election has not changed. For much of United States history, STEM-educated congresspeople have consistently made up less than 10% of Congressional membership. So what's keeping our engineers from joining the political cause?

"I feel that engineers do a very good job of keeping themselves in certain silos," said Faith Carter, petroleum engineering junior and Student Government Engineering Representative. "We have a few people — there are always outliers — but typically engineers do stick to industry. You don't see a lot of engineers in politics, and you don't see a lot of engineers in government."

Marco Heredia, chemical engineering senior and Student Engineering Council President, also agrees that engineers tend to shy away from the policy aspect of science and technology.

"In general, I think a lot of engineers avoid that space. I think part of that is by choice, engineers by nature want to create more tangible things, they want to work directly on innovation and outlining the future. I don't think that policy is often a very tangible of doing that."

Here is the breakdown of STEM majors in the 114th Congress: of the 541 members of Congress, only 11 hold STEM-related degrees, and 8 of those 11 are engineering degrees. Currently the only U.S. senator with an engineering degree is Sen. Martin Heinrich (D—NM), who was a top vice presidential hopeful for Democratic nominee Hillary Clinton. In the past, the U.S. has seen few engineers holding offices. President Jimmy Carter held an undesignated Bachelor of Science Degree from the U.S. Naval Academy, while Herbert Hoover received a degree in geology from Stanford University before working as a mining engineer.

"I've always thought that if an engineer had the opportunity of becoming President, the entire idea of what an engineer is could change, because at the core, engineers are problem solvers," Carter said. "I also feel that the strategies that engineers have and the things we're taught can be applied to so many other levels that we're not currently looking at."

Most people associate engineering with utility and innovation over politics. But this doesn't rule out what engineers can bring to the world of policy, especially in this day and age. Carter, speaking from a petroleum engineering background, said petroleum engineers could bring alternative and more in-depth perspectives on the roles of oil and gas in climate change, as well as the most effective ways to deal with the issue.

"Something I've noticed is there's a lot of conversation about climate change, and there should be, but I think sometimes people such as petroleum engineers are far removed from the conversation. I think if there were instead more interface between petroleum engineers and environmental engineers, for example, we'd be able to create better policies and improve our operating practices in these fields. We'd be able to impact more effective change."

> *"...I think engineers should get a better understanding of public policy, because that is what will have the direct impact on the world."*

Heredia added that while he doesn't feel engineers are well represented in today's government, he doesn't think this means they lack the skills necessary to become good policymakers or politicians. Politicians, he said, tend to be more generalist since they have to relate to the public and will rely on experts of other fields from time to time; engineers, on the other hand, might be more the experts in their field, and can use this to be better informants of the issues to the public. Examples of influential engineers include Bill Gates and Elon Musk, who have used their following to incite curiosity and knowledge in the public for various topics.

"The caveat there is I think engineers should get a better understanding of public policy, because that is what will have the direct impact on the world," Heredia said. "Engineers don't always have an appreciation for the fact that policy has to happen in order to get their innovations to happen… If you can't explain or show to the public or put into policy why this new emerging technology is worth it, it will never become a reality, it won't hit the real world."

Heredia stated the example of the energy space to explain the notion of the marriage of engineering and policy. With the energy industry being

as complex as it is, there weren't many regulations for new technologies in renewable energy, oil, and gas until very recently.

The flip side of this issue is discussing the role of engineers as public informants. Oftentimes the public itself will be misinformed or under-informed about an issue because of its oft-perceived 'niche' quality. Heredia mentioned a U.S. bill passed in the 1970s against construction of natural gas plants, because of a perceived natural gas shortage. As a result, the country became more dependent on coal power plants. When it was revealed later that natural gas reserves were in fact in surplus, the cost had already become too high to stray away from coal power plants again.

Carter recalled some of the myths of her field she has encountered in the past. "Whenever I say I'm a petroleum engineer, people are always like 'Oh fracking, fracking.' And the thing is, when we're in school, petroleum engineers are taught that basically the issue with fracking is the myth. Which I know is false, it's not a myth, things go wrong and horrible things can happen. And then on the other hand, people who don't know a lot about petroleum engineering will say every time fracking happens, bad things happens. Which is not true either. So that's why I feel the interface needs to be there, to provide a more effective dialogue."

Access to unbiased, yet still informative information is key to making more of these issues relatable to the public. Both Carter and Heredia agreed that whether in school or in media, the issues we deal with today must be clearly relayed to the public, void of sensationalism or esoteric relationship.

"I feel like these days you will go to a news website and everything is very political or dramatized, but it doesn't tell you what exactly the issues are, just that people are feuding over them," Heredia said. "I'm just imagining a website that can give you all these topics and just a two to three minute rundown clip on what these seemingly complex issues are."

Carter added that a more interdisciplinary approach to teaching engineering, involving both science and ethics, is necessary to make students more aware of the impact of their decisions. Thus, even though encouraging engineers to look into policy is a work in progress, advocating ethics, public awareness, and responsible reporting of the facts is key for the continued success of engineering, both in innovation and public opinion. Carter recalls her class on drilling, a controversial issue itself, in which her professor included a problem on determining the carbon emissions of a particular operation. He told the class that he felt it was important his students be conscious of the impact they may leave during a project.

"It was the first time I ever had an engineering professor ever express that sort of connection with the education that we're getting," Carter said. "If all professors could connect the issue that everyone's dealing with the issue we're dealing with in the course, I think [it would make for] a more well-rounded engineer."

"Engineers don't always have an appreciation for the fact that policy has to happen in order to get their innovations to happen,"
- Marco Heredia

"I've always thought that if an engineer had the opportunity of becoming president, the entire idea of what an engineer is could change, because at the core, engineers are problem solvers."
- Faith Carter

Cockrell Cares

Highlighting the exceptional engineering organizations on-campus

written by Nyle Ashraf • *layout by* Audrey Gan • *photos by* Jacob Stehsel and Emily Crowell Stevens

"What starts here changes the world." These six words instill pride within us all and define our time as Longhorns. However, with this motto comes great responsibility – the responsibility to make use of our extensive resources to help those around us. The student-led organizations and programs within the Cockrell School of Engineering take this to heart, participating in events and projects that create a lasting impact on the greater community.

Introduce a Girl to Engineering Day

1,300 volunteers and 140 student organizations head an event that could potentially usher in a new generation of curious, creative engineering minds. Introduce a Girl to Engineering Day began as an avenue to increase children and adolescent interest in engineering but, with the inception of the Girl Day STEM Festival, has recently grown to correct the lack of women majoring in all STEM disciplines. The day kicks off with a high-energy engineering presentation by Halliburton Company, ends with a proclamation of "Science is awesome" by Google, and contains just about every activity you can possibly think of in between. Every department has activities and presentations that showcase different engineering concepts in a way that can be understood by children.

Additionally, many women majoring in engineering work with the children, and this interaction makes all the difference in the world.

"The two most important aspects of this event are the direct interaction with engineering concepts and the relationships cultivated between the women engineering students and the children," said Masa Prodanovic, assistant professor of petroleum and geosystems engineering. "These role models help the girls visualize where they want to be and stay on track when things get rough."

Many internal and external factors, such as social stigmas and academic difficulties, can hurt students' confidence and push them in a different direction. However, seeing older students who have overcome these same obstacles can invigorate them and give them a steady path to follow. This event continues to grow and shows no signs of stopping, exponentially increasing its levels of participation over the last few years.

UTeach

Throughout each of our academic careers, certain teachers stand out – whether they teach with a true enthusiasm for the subject or help bring out the best in you, teachers can leave a lasting imprint on our lives. By inspiring STEM graduates to pursue a career in education, UTeach helps facilitate this strong student-teacher connection. Students within the program work their way up the teaching ladder incrementally, taking small steps to ensure that they get the most out of every experience.

The first step consists of students observing diverse elementary school classrooms instructed by exemplary teachers. Over the course of the semester, students prepare three science or mathematics related lesson plans and teach the

classroom. As the students get more experience and instructor feedback, they are able to improve with each successive lesson. The second step involves creating inquiry-based lesson plans for sixth, seventh, and eighth graders to help develop teaching strategies for secondary school curricula. These experiences culminate in the final semester of apprentice teaching, which allows the UTeach students to take on their most substantial role as teachers. Rather than simply observing the classroom, apprentice teachers instruct the classroom on a daily basis and forge personal connections with their students. Additionally, it is during this semester that students can take the required exams – Pedagogy and Professional Responsibility and a content-based exam – that completes their teacher certification.

The UTeach program develops many exceptional teachers with unique goals in mind. As Charles Wang, biomedical engineering alumnus and current student teacher, said, "I'm aiming to help my students learn how to teach themselves, because in the real world, knowing how to teach yourself different concepts is essential in the workplace."

Teachers that go above and beyond to help prepare their students for the real world play a tremendous and necessary role in society.

Engineers for a Sustainable World

In a world affected by environmental issues, any innovative solutions that promote sustainability will have an immediate impact. The multi-disciplinary organization Engineers for a Sustainable World brings bright minds with various perspectives together to solve both local and global sustainability problems. These problems are not one-dimensional – in order to solve these complex issues, different mindsets are necessary to view the problem from every possible perspective.

To promote sustainability around campus, ESW builds projects that focus on a certain aspect of sustainability. One of the projects that came to fruition last year was a solar-powered smoothie cart – with a large solar panel powering the cart, students around campus were able to buy delicious smoothies and learn more about renewable energy! This outside-of-the-box thinking defines ESW and their projects. Some of their potential plans for the future include a biodiesel reactor to make use of waste oil from campus kitchens, additional modifications to their aquaponics project, and even a dance floor that can generate electricity!

These projects may seem daunting, but as Caroline Kung, chemical engineering junior and co-director of outreach, said, "The people behind each project are the members – from its inception to the final product, the members are there every step of the way."

Additionally, ESW holds a number of volunteering events that seek to get members directly involved with sustainability causes. In conjunction with Keep Austin Beautiful, some of their events involve members volunteering to help keep Austin clean and free of waste.

One of their recent events showcases their novel ways of tackling environmental problems. Myco Alliance, an Austin-based LLC that focuses on fungi and their applications to bioremediation, owns a former brownfield that they have since converted to a nature preserve. ESW volunteered at their nature preserve to get first-hand experience with their bioremediation techniques. As Savanna Smith, civil engineering sophomore and co-director of outreach, said, "Myco Alliance's innovative research is a great opportunity for our members to learn about and contribute to a new sustainability initiative."

ESW continues to build more projects and hold more events that showcase creative sustainability concepts, and as the push for sustainability continues forward, so will this organization.

PROJECTS *with* UNDER-SERVED

written by Aradhana Sridaran layout by Emily Hood photo by Brendan Towlson

Projects with Under-Served Communities, PUC, is truly a game changer when it comes to the study abroad experience. Essentially, PUC is a program that facilitates the collaboration between students of the School of Social Work and the Cockrell School of Engineering to design, fundraise, and implement an engineering project in an underserved community. These projects have so far taken place in developing nations where students extensively work with nonprofit government organizations (NGOs), contractors, and local partners to help bring their project to completion.

Launched in 2010, this program requires students to take three innovative classes over the course of two semesters and one three-week summer term. During each semester class, students complete a rigorous curriculum which helps them investigate the needs of their assigned community, target a particular problem, and design a plausible engineering solution accordingly. In the summer, all their hard work and planning is finally implemented and the project comes to life.

This year, three groups of students are traveling to India, Guatemala, and Thailand to change the lives of hundreds of people. As students of UT Austin, they truly exemplify our university's motto of "What Starts Here Changes the World." Here are their inspiring stories:

This summer, chemical engineering senior Harsha Rao will travel with Team India to the city of Tirunelveli in the state of Tamil Nadu. There, he will help build – alongside the team's contractors – a community center for an underrepresented community, since the state government is having a hard time tending to their requests. "This community petitioned their needs to our NGO, Church's Auxiliary for Social Action (CASA), which then reached out to us," Rao said. "So we are designing this project now."

He hopes that this community center can act as a gathering area for the surrounding villages where its inhabitants can potentially host classes to teach young children and older villagers alike, conduct meetings, and catch up on day-to-day information.

"Hopefully, there will be computers and internet too," said Rao. Since the project will be implemented in another country, it's important to note that different regulatory policies are to be expected.

"Building codes in India are different from the building codes here," said Rao. "We are still in the formative stages of our project and we're still defining our scopes in figuring out how much funding we have to get, so we haven't had a chance to fully discuss that aspect but definitely something we have to keep in mind."

It's easy to forget, though, that PUC is a challenging program to complete. It requires a lot of time and dedication before the project can come to fruition. So what keeps him going?

"I think with engineering in general, in school everything that you learn is sort of theoretical and to some extent, has boundaries," said Rao. "You know what's supposed to happen, and usually there is always a definite answer to the question asked. But in real life, there is no concrete answer because everything depends on the situation. So what I'm getting out of PUC is being part of a real-life engineering problem".

Also traveling to another country this summer is chemical engineering sophomore Nicholas Curtis. He is part of Team Thailand, and plans to help build a water filtration system in Don Kang. The goal, he says, is to provide 400 homes and about 150 people with access to clean drinking water which they currently don't have.

> "You know what's supposed to happen, and usually there is always a definite answer to the question asked."

One of the complications for students involved with PUC is that they have to determine one need – out of several problems a community is facing – to design and develop a project for. To determine that one need, students must think from all angles such that the benefits a community reaps are maximized.

"This project was the one that was most requested by our NGO that we work with," said Curtis. "The next two projects that are probably going to come in following years just have much less importance because, obviously, water is a daily need. One of the other projects is a playground for children, and as important as that may be, water is more critical at least in the sense of time."

As complex as weighing the pros and cons of each need in a community is, even more complex engineering problems tag along after a need is chosen. "First of all, we don't know entirely what their system looks like over there." said Curtis "We don't know what the conditions of the pipes are, how the previous systems – which have failed – have worked in the past. So the main engineering challenge for us is diagnosing the problem and finding out in every worst-case scenario how to approach the situation in order to make it work."

With all the technical work involved with PUC, the social aspect of the program can be overlooked. However, communication and social interaction is the biggest barrier of all. Even though an elementary knowledge of a country's language or customs in not required when entering the program, it is essential for every student to develop this knowledge in order for the project to run smoothly.

"There are a total of zero people in our group that speak Thai." said Curtis. "It's a language with five tones as well as at least 40 different consonants and vowels. Currently, the only contact that we have that speaks English fluently from that region is Khem, our non-governmental sponsor. It's nice, but unfortunately, that means that all the equipment over there, all the engineering specs are in Thai. Slowly but surely, we've been deciphering them all. Google Translate has been really helpful."

Finally, also traveling to help save lives this summer are civil engineering seniors Sebastian Farkas and Emily Hannon. Both will be traveling to El Progreso, Guatemala to help install – with the guidance of their NGO's partner, AP1 - solar panels at the only malnutrition clinic in El Progreso. Their main goal is to indirectly help the clinic by decreasing the cost of their electrical bill so that the malnutrition clinic can allocate additional funds to things such as clothing for the babies, hiring more workers, medical supplies, and more.

COMMUNITIES

However, this project isn't totally on stable ground yet. In PUC, students choose their projects based on what need is the most important at that present moment. But the needs of a community can change very rapidly as some problems are fixed and new problems arise. "We just received an email today stating that the malnutrition clinic is receiving energy from the grid, previously it wasn't," Farkas said. "In other words, before, the clinic had no access to any type of 'legal' utilities. They had been illegally getting their energy from their neighbor who charged them $200 monthly."

"That being said, we could still do the project, but now we don't know how much the malnutrition clinic is paying for energy," said Hannon.

"It's still a good cause and the project would still alleviate the burden on the community," Farkas said. "But after we got this information, we're kind of opening the door to alternative projects that neighboring communities can benefit from."

In the end, it's important to realize that there definitely are pros and cons to the unpredictability of PUC. This program trains students, early on, to face this challenge head on. Like with any real-life project conducted in industry or graduate school, the timeline of events leading up to its completion may not be smooth. However, but PUC students have all the right skills to overcome it.

In regards to engineering and regulatory policies this project has to tackle, team Guatemala has a whole slew of different problems to deal with.

"Every country handles their energy differently. For example, in Mexico, you won't receive credits if you send energy back into the grid whereas in the U.S, you do. So we have to look out for little differences like that." said Farkas.

"Generally in developed countries, the environmental and engineering standards are much higher than those in developing countries," Hannon said. "Our goal is to meet U.S. standards in Guatemala while also making our project entirely sustainable such that the project lasts for a long period of time".

PUC isn't just about the engineering. It's also about the communication, project management, budgeting, and so much more that isn't necessarily technical.

"PUC is a tremendous opportunity for personal growth" said Hannon. "You can't predict in what ways that is true but you realize that it's something that a lot of people our age do not have the opportunity to partake in."

To learn more about the PUC program and how to apply, visit the PUC homepage: http://world.utexas.edu/abroad/programs/puc

To help the teams fundraise for their project, follow the links below to donate. The donation period is October 31, 2016 to November 31, 2016.

https://hornraiser.utexas.edu/pucguatemala2017
https://hornraiser.utexas.edu/Thailand
https://hornraiser.utexas.edu/project/2990

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"Exploring Austin's many attractions like Pennybacker bridge has definitely made me feel more like Austin is my home away from home."

ALLIE RUNAS

Pennybacker Bridge at Night

the Blue Yonder

recommendations for exploring campus and beyond

layout by Rachel Scott

DO INCREDIBLE THINGS.

photo by Rachel Scott
Mechanical Engineering sophomore Taylor Galliete in front of the Philadelphia Historic City Hall